

**Environmental Protection Indicators for California (EPIC)  
DRAFT ISSUE STRUCTURE WITH DEFINITIONS**

**ISSUE CATEGORY: HUMAN HEALTH RELATED TO ENVIRONMENTAL EXPOSURES**

Pollutants in our environment have been documented to be associated with a wide variety of adverse health impacts in humans. Protection of public health from environmental contaminants is an essential part of Cal/EPA's strategic vision. Human health effects from exposure to environmental agents can be subtle, such as small deficits in lung function or slight irritation; or obvious, such as an asthma attack or sudden death resulting from acute exposures. This issue category includes chronic and intermittent exposures to chemicals present throughout our environment, whether they are present in the air, water, or soil. Resulting adverse health effects may occur only after many years of exposure. Thus, it is often difficult to strongly associate a causal relationship of a specific contaminant to a certain disease state.

An additional dilemma is that there are many influences that impact the occurrence of human disease, many of which may have little to do with exposures to environmental contaminants and may actually mask their effects. Therefore, the list of issues focus mainly on specific adverse health effects that have been associated with environmental exposure to pollutants. Examples of strong associations include mesothelioma resulting from exposure to asbestos, because mesothelioma is normally an extremely rare disease. Other examples include acute effects that can be related to episodes of high contaminant exposure, such as exacerbation of asthma during poor air quality days in urban settings.

In addition to the general category of adverse human health effects, interest in the specific evaluation of health risks to children from environmental contaminants has intensified in recent years. This is primarily due to exposure patterns and special susceptibilities, relative to adults, that result in disproportional higher exposure and/or greater sensitivity to environmental contaminants. Children may be more vulnerable than adults due to their limited variety diets and higher intakes of contaminants per body weight of food, fluids and air. Infants may be exposed to contaminants that concentrate in breast milk. Children also have greater contact with ground surfaces resulting in a higher potential for soil ingestion exposure. Thus, for environmental contaminant health issues in which differential effects may occur, the indicators will be separated for adults and children.

**Issue 1: Bioaccumulation of Toxic Chemicals**

Certain toxic chemicals, although present in low concentrations in air and water, may accumulate in the human body over time to levels, which could potentially cause disease. These chemicals include certain persistent organic pollutants (POPs) and some metals. They resist environmental or biological degradation, causing them to persist in humans, biota and the environment. A major concern in childhood development has been to lead exposure. Previously, adults as well as children have been exposed to airborne lead as a result of auto emissions. Currently, children in urban areas are more likely to be exposed to lead from old lead-based paint flaking off from buildings.

***Sub-issue 1.1: Persistent Organic Pollutants (POPs)***

The POPs include PCBs, PBDEs, polychlorinated dioxins, furans and certain pesticides. POPs generally reside or accumulate in high-fat containing tissues. Lactating mothers utilize their fat stores to produce breast milk, and in so doing mobilize the fat-stored POPs as contaminants into the milk. Therefore, human milk is an ideal form for non-invasive and simple means to monitor body burdens. Post-mortem examinations of human tissues can also reveal POPs body burdens from a lifetime of exposure.

***Sub-Issue 1.2: Lead in children and adults***

Lead toxicity in children has been recognized as a major environmental health concern for a number of years. At present, no blood lead level has been recognized to be safe. Blood lead levels of over 10 µg/dL in children have been associated with decline in intelligence and reading, learning disabilities, impaired hearing and reduced attention spans. The major source of the lead to children has been from lead in gasoline and paint. However, due to cessation of the lead use in these sources, children's blood lead levels have declined substantially. The remaining sources of lead remain are from soils contaminated with deposits of lead paint from pre-1978 buildings and fallout of lead from past emissions from gasoline. Information concerning children's blood lead content is not collected from all children in the state. However, two hospitals in urban areas of the state routinely report to the state all blood lead information from children seen at their outpatient facilities. The information collected from these hospital laboratories will be used to assess the trend in children's blood lead levels.

***Sub-issue 1.3: Mercury in children and adults***

Mercury in the environment comes from both natural and anthropogenic sources, and may interconvert among several different forms. Of particular concern is the conversion of inorganic mercury to methylmercury, largely by microorganisms, which bioaccumulates up the food chain and can reach very high concentrations in some fish, many of which are consumed by humans. Thus the principal sources of exposure to mercury in the general population are ingestion and inhalation of mercury compounds from dental amalgams, and ingestion of fish (fresh water and marine) and seafood which contain mercury, primarily as methylmercury. While the brain and the kidneys are the primary targets of mercury toxicity, the developing nervous system is especially sensitive to the toxic effects of low level mercury exposure. Thus, mercury exposure to women of childbearing age is of great concern. At higher exposure levels, mercury may adversely affect the immune, respiratory, cardiovascular, gastrointestinal, and hematologic systems. US EPA has calculated a reference dose of 0.1 µg/kg-day based on evidence of neurotoxicity in children exposed *in utero* to methylmercury in the maternal diet.

Recent preliminary estimates of blood and hair Hg levels from the 1999 National Health and Nutrition Examination Survey (NHANES) suggest that Hg levels in young children and women of childbearing age generally below those considered hazardous. These estimates also show that approximately 10% of women have Hg levels within one tenth of potentially hazardous levels indicating a narrow margin of safety for some women and supporting efforts to reduce methylmercury exposure. CDC's NHANES is a continuous survey of the health and nutritional status of the U.S. civilian, noninstitutionalized population

in which California-specific data can be segregated, but it remains to be seen whether it will be useful in generating meaningful conclusions.

## **Issue 2: Environmentally Related Health Conditions, Disease and Cancer**

Various health-related conditions, disease and cancer have been associated with exposure to chemicals. Cancer has been shown to be associated with exposure to chemicals mostly in occupational settings, where high exposures occur. Environmentally, when lower exposures predominate, the associations are not very strong. Thus, it is difficult to associate environmental agents with cancer incidence. Environmental risk factors were associated with a wide variety of adverse respiratory health impacts in humans. These effects could range from irritation to induction of asthmatic attacks. Air pollution may also lung growth and respiratory health of school-aged children. Little is known about the effect of environmental agents on developmental and reproductive outcomes.

### ***Sub-issue 2.1: Cancer Incidence***

Cancer is predominantly an adult disease of high frequency. Environmental chemicals have been associated with increased incidences of cancer, however cancer is generally a very poor indicator of environmental risks. It has been estimated that environmental pollution causes 2% of cancer deaths in the U.S. However, the major cancer risk factors including smoking, diet, inactivity, and obesity, which constitute more than 65% of cancer deaths confound this cause of cancer. Other factors such as the long latency times to onset of cancer further confound environmental causes of cancer. A strongly associated cancer with an environmental source is mesothelioma associated with asbestos exposure. Mesothelioma is extremely rare without exposure to asbestos, but deadly cancer. Several areas of California have high natural deposits of asbestos in their soils, which could result in human exposures. However, long latency times (20-50 years) make it difficult to know case histories. Currently, most known cases of mesothelioma are attributable to occupational exposures, which is a very preventable form of exposure. Eventually, occupational cases should diminish and those from environmental exposure more clearly identified.

### ***Sub-issue 2.2: Respiratory effects from environmental contaminants in children and adults***

Respiratory system impacts associated with environmental pollutants include increased acute respiratory disease morbidity; aggravation of asthma; increased prevalence of respiratory symptoms in children, and infectious episodes of longer duration; lowered lung function in children when pollutants increase and lowered lung function. Environmental exposure to allergens and air pollutants has been implicated as contributors to adverse respiratory effects. Exposure to tobacco smoke contributes to onset of asthma earlier in life and is a risk factor for asthma morbidity. Environmental tobacco smoke is a major concern for children in indoor or household settings.

### ***Sub-issue 2.3: Environmental Influences on reproductive and developmental Health***

This area is still being researched.